

BIOEXPLORATION OF WILD ALASKAN BERRIES: FROM FIELD SCREENING TO FUNCTIONAL FOOD

BY

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THESIS

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ABSTRACT

Wild berries are fundamental components of traditional diet and medicine for Native American and Alaska Native tribes and contain a diverse array of phytochemicals, including anthocyanins and proanthocyanidins, with known efficacy against metabolic disorders. Bioexploration represents a new paradigm under which bioactive preparations are screened in coordination with indigenous communities, to prepare for subsequent in-depth chemical and biological analysis. The inclusive, participatory philosophical approach utilized in bioexploration has additional benefits that could be realized in seemingly disparate areas, such as education and economics.

Five species of wild Alaskan berries (*Vaccinium uliginosum*, *V. ovalifolium*, *Empetrum nigrum*, *Rubus chamaemorus*, and *R. spectabilis*) were tested using “Screens-to-Nature” (STN), a community-participatory approach to screen for potential bioactivity, in partnership with tribal members from three geographically distinct Alaskan villages: Akutan, Seldovia, and Point Hope. Berries were subsequently evaluated via HPLC and LC-MS², yielding significant species and location-based variation in anthocyanins (0.9-438.6 mg eq /100g fw) and proanthocyanins (73.7-625.2 mg eq /100g fw). A-type proanthocyanidin dimers through tetramers were identified in all species tested. Berries were analyzed for *in vitro* and *in vivo* activity related to diabetes and obesity. *R. spectabilis* samples increased preadipocyte-factor-1 levels by 82% over control, and proanthocyanidin-rich fractions from multiple species reduced lipid accumulation in 3T3-L1 adipocytes. Furthermore, extracts of *V. uliginosum* and *E. nigrum* (Point Hope) reduced serum glucose levels in C57bl/6j mice up to 45%.

The same precepts of bioexploration, especially the inclusion of indigenous community perspectives and knowledge, have relevance in other areas of study, such as education and economics. Studies have established the apathetic, low-motivational

environment characteristic of many introductory science laboratory classes is detrimental to student interest, learning, and continuation in scientific education. A primary means of arresting this decline and stimulating the students' attention and excitement is via engagement in hands-on experimentation and research. Using field workshops, the STN system is investigated as to its potential as a novel participatory educational tool, using assays centered around bioexploration and bioactive plant compounds that hold the potential to offset human health conditions. This evaluation of the STN system provided ample evidence as to its ability to augment and improve science education.

Furthermore, Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis was employed as a theoretical framework to review the potential benefits and hurdles associated with developing a wild Alaskan berry commodity. Synthesizing various sources of information - including logistics and harvest costs, sources of initial capital, opportunities in the current superfruit industry, and socioeconomic factors - the development of a berry commodity proves to be a complex amalgam of competing factors which would require a delicate balance before proceeding.